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Laparoscopic Renal Cryoablation: Single Institutional Experience from South America

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Abstract

Objective: Minimal invasive thermal ablative techniques are emerging as a viable option for patients who are not candidates for open, laparoscopic or robotic-assisted partial nephrectomy. Cryoablation is a low risk alternative with good oncologic outcomes. We present our initial experience with cryoablation for small renal masses using the laparoscopic approach.

Patients and Methods: We prospectively collected the perioperative data of patients undergone renal cryoablation at our institution. From May/2009 to January/2011, 41 patients with incidental small renal mass were submitted to laparoscopic cryoablation.

Results: The mean patient age was 58.8 years. The mean operative time was 115.4 ± 60.3 min and no patient needed blood transfusion. The mean of size tumors was 2.8 cm (1-5 cm). Intraoperative biopsies showed 27 (65%) malignant tumors, 5 (12%) oncocytomas, two (6%) angiomyolipomas 7 (17%) inconclusive. With a mean follow-up of 16 months (12-21), there were no significant differences between creatinine, estimated glomerular filtration rate and hemoglobin level before and after the procedure. There was no open conversion, kidney loss, urinary fistula, dialysis requirement or re-operations.

Conclusion: Laparoscopic renal cryoablation is safe, with low complication rate and short learning curve.

Keywords: Kidney cancer; Cryoablation; Outcomes; Laparoscopy

Introduction

The constant raising incidence of small renal tumors has become a great dilemma for the urologist. Currently, 39% of the diagnosed renal masses are <4 cm, and malignancy cannot be safely established by radiological methods and, although the accuracy of percutaneous biopsy has improved, inconclusive biopsies results still exist and are subject to pathologist variability [1]. Nephron-sparing surgery with partial nephrectomy has been adopted as the treatment of choice, however it may present some perioperative morbidity especially for elderly and poor surgical risk patients [1,2] (Table 3).

In this scenario, minimal invasive thermal ablative techniques are emerging as a viable option for patients who are not candidates for open, laparoscopic or robotic-assisted partial nephrectomy. The available literature shows that cryoablation could be a low risk alternative with good oncologic outcomes. We present herein our initial experience with cryoablation for small renal masses using the laparoscopic approach.

Patients and Methods

Prospective perioperative data were collected of patients undergone renal cryoablation in our institution. From May/2009 to January/2011, 41 patients with incidental small renal mass were submitted to laparoscopic cryoablation. We have included all consecutive diagnosed patients with T1 solid renal tumors less than 5 cm width. Patients with hilar mass or in contact with vessels were excluded. The present study was approved by the Institutional Review Board/Ethics Committee and Informed Consent was obtained from every patients.

Briefly, during the transperitoneal approach, after abdominal insufflation and port placement, the colon was medially mobilized and the Gerota's fascia exposed. The Gerota's was then incised and the tumor was identified and exposed. Intraoperative ultrasonography was performed in order to precisely identify the tumor limits. A biopsy was performed in all cases before the percutaneous insertion of the cryoprobes. Two cycles of 15 minutes freeze-thaw cycles were used, with active thaw, and biological sealant was applied in the probe insertion. The Gerota's fascia was closed with interrupted 0-Vycril sutures. During the freeze cycles, real-time ultrasonography guidance was used to assure that the ice ball was at least one centimeter beyond the tumor borders.

The perioperative parameters evaluated were operative time, transfusion rate, opioids need, hospital stay, and complications as proposed by Clavein et al. [3]. All patients are being followed with the same protocol, with CT/MRI performed at first postoperative day; 3, 6 and 12 months. Renal functional outcomes were also evaluated with serum creatinine and glomerular filtration rate like proposed by Cockcroft and Gault [4].

Statistical analysis was performed using SPSS 12.0. Student T tests and Chi-square tests were used to compare continuous and categorical variables respectively.

Results

Forty one patients (25 men), were submitted to laparoscopic cryoablation in our institution during the study. The mean follow-up was 23 months (12-32). The mean age, preoperative serum creatinine and serum hemoglobin were 58.8 ± 11.8 yrs (39-76), 1.03 ± 0.27 mg/dL (0.66-1.67), 13.8 ± 1.6 g/dl (11-17), respectively (Table 1).

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Age (years)	59.9 ± 11,8
Men	25 (61%)
Body Mass Index	27 ± 3
Diabetes mellitus	(11) 28%
Systemic Arterial Hypertension	(27) 66%
American Society of Anethesiologists	
1	18%
2	68%
3	14%
Previous abdominal surgery	3 (7%) (1 gastrectomy, 1 radical prostatectomy, 1 apendicectomy)

Table 1: Demographic data.

AP	N	Size (cm)			Gender		Age
			Exophytic	Endoexophytic	M	F	
RCC clear cell	17 (41%)	2.7 ± 0.7	16	1	12	5	54.7 ± 10.5
RCC Papillary	10 (24%)	2.2 ± 0.4	9	1	8	2	58.5 ± 15.2
Oncocytoma	5 (12%)	2.8 ± 0.4	5	-	3	2	59.5 ± 13.4
Angiomyolypoma	2 (6%)	5.0	2	-		2	70 ± 8
Inconclusive	7 (17%)	3.0	6	1	2	5	58.3 ± 14
Total	41	2.8 ± 0.8			25	16	58.9 ± 11.8

Table 2: Pathologic, demographic and anatomic tumor characteristics.

Operative time (range) min	115.4 ± 60.3 (55-270*)	p
Hospital stay (range) days	2.6 ± 1 (2-5)	
Transperitoneal approach	16 (88.9%)	
Opioids need	2 (11%)	
Hematuria	28% mean 1.8 days	
Urine leak	None	
Organ injury	None	
Transfusion	None	
Mean mg/dl serum creatinine preoperative (range)	1.03 ± 0.27 (0.66-1.67)	0.47
Mean MG/dl serum creatinine postoperative (24h) – (range)	1.14 ± 0.63 (0.54 -3.49)	
Mean ml/min/1.73 m^2 eGFR (range) preoperative	83.5 ± 29.9 (37.8 - 170)	0.9
Mean ml/min/1.73 m^2 eGFR (range) postoperative	83.7 ± 39.4 (18.1 – 207.8)	
Hemoglobin pre (range)	13.8 ± 1.6(11.1-17.2)	0.10
Hemoglobin post (range)	12.9 ± 1.4 (10.6-15.4)	
Clavien-Dindo classification	I (12%)	
	II (5%)	
	III, IV, V (none)	

*cholecystectomy associated to the cryoablation procedure

Table 3: Procedure and morbidity data.

Intraoperative biopsies showed 27 (65%) malignant tumors, 5 (12%) oncocytomas, two (5%) angiomyolipomas 7 (17%) were inconclusive. The mean of size tumors was 2.8 ± 0.8 cm (1-5).

The mean operative time was 115.4 ± 60.3 (55-270) minutes and no patient needed blood transfusion. Two patients (5%) required opioids for postoperative pain control. Five patients (12%) had hematuria that lasted 1.8 days. The average hospital stay was 2.6 ± 1 days (2-5), and discharge was mostly given on the second day after surgery (55%). There were no significant differences among creatinine (1.03 ± 0.27 *vs* 1.14 ± 0.63, p=0.47), estimated glomerular filtration rate (83.5 ± 29.9 *vs* 83.7 ± 39.4, p=0.9) and hemoglobin level (13.8 ± 1.6 *vs* 12.9 ± 1.4, p=0.1) before and after the procedure. One patient with gallbladder stone was submitted laparoscopic cholecistectomy in the same procedure. Although no bleeding was observed during cryoablation, the cholecistectomy presented technical difficulties secondary to adhesions and the hemoglobin level dropped to 10 mg/dl, creatinine raised to 3,49 and hospital stay was 5 days. She did not need blood transfusion or dialysis. There was no open conversion, kidney loss, urinary fistula, dialysis requirement or reoperation. After treatment we had six (14%) failures identified by CT control. Of these three patients underwent open partial nephrectomy, two underwent video laparoscopic partial nephrectomy and only one was clinically followed up with CT (oncocytoma on previous biopsy). Of these patients four were identified renal cell carcinomas and only one with necrosis.

Discussion

The more common complications related to cryoablation are pain and paresthesia in puncture site; symptoms that disappear with habitual initial clinical support. Major complications as hematoma, pancreatic, hepatic, spleen or bowel injury are very unusual. A multi-institutional review [5] showed 19 complications in 139 procedures, with 2 major and 17 minor complications. Of the total, 16 occurred in non-laparoscopic guided cases. Our study suggests minimal morbidity related to laparoscopic cryoablation. These results are better than the complications reported in other series in literature that shows complication rates among 5% and 30% [1].

In a meta-analysis recently published [1], 145 laparoscopic cryoablation procedures, presented occurred complication rate of 15%. The most common complication was ileus (7–5%), urinary tract infection (5-4%) and bleeding required transfusion (2-1.4%). Multivariate analysis showed that tumor size, presence of cardiac conditions and women gender were independent predictors of perioperative complication. However, the majority of these studies were retrospective and few data, with no uniform parameters to evaluate morbidity (Table 2).

We observed that the procedure learning curve might be short. In our experience, even in the initial cases there were no complications related to the procedure and the operative time was acceptable (115 min). Comparing with the literature in more experience centers, our results were similar. Weld et al. [6], published 81 laparoscopic cryoablation with a mean operative time of 183 ± 72 min. The laparoscopic skills required for this procedure is minimal, as well as the handle of intraoperative laparoscopic ultrasound, even with no radiologist assistance.

The main limitation of this study is the short follow-up. However, there are several studies that provided short-term oncological acceptable results. A metanalysis performed by Kunkle and Uzzo [7], of a total of 1375 lesions, 600 were treated by cryoablation, and the laparoscopic approach was employed in 65% of these. The local tumor progression was 1% in a mean follow-up of 18.7 months. Bachmann et al. [8] related their experience with retroperitoneal cryoablation. At the mean follow-up of 13.6 months, no relapse was observed. Gill et al. [9] related the largest experience with renal cryoablation, with 115 patients and a mean follow-up of three years. The average tumor size in this series was 2.3 cm and mean operative time was three hours. The estimated blood loss was 87 ml, and major complications occurred in two cases. Cancer specific survival was 98%. Davol et al. [10] reported 48 patients with a mean follow-up of 60 months, and mean tumor size of 2.6 cm. 12.5% patients presented persistent disease during the study period. The cancer-specific survival rate was 100%, and the cancer-free survival rate after a single cryoablation procedure was 87.5%. This improved to 97.5% after a second ablation. No major complications were observed. The Cleveland Clinic group published long-term

oncological outcomes after laparoscopic renal cryoablation [11]. In 55 patients with RCC, overall, cancer-specific and recurrence-free survival rates were 84%, 93% and 81% at 5 years, and 51%, 83% and 78% at 10 years, respectively. In our series, 5/41 (12%) patients had treatment failure, and were promptly rescued by partial nephrectomy. We not found any explanation for this high frequency of failure because all this cases were favorable.

Literature supports a slight superiority in oncological outcomes compared to radiofrequency [6]. It is not evident that this difference in tumor destruction is a function of inherent differences in the ablation technologies themselves or whether the laparoscopic approach provides a greater propensity for effective tumor treatment than percutaneous approaches [7]. Intuitively, an anterior tumor would be easy to locate with the laparoscopic approach, while the percutaneous route with a lower morbidity rate [12], which is performed with local anesthesia avoiding endotracheal intubation and the pneumoperitoneum, would be ideal for approaching posterior located tumors.

Conclusions

Technically laparoscopic renal cryoablation is feasible and safe. Short-term oncological results are encouraging but long-term follow-up is still necessary to assess true treatment oncologic efficacy.

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